R E P O R T R E S U M E S

ED 014 496 56 TE 500 006

RESEARCH ON SPEEDED SPEECH AS AN EDUCATIONAL MEDIUM. PROJECT REPORT.

BY- ORR, DAVID B. FRIEDMAN, HERBERT L.
AMERICAN INST. FOR RESEARCH IN BEHAVIORAL SCIENCES

REPORT NUMBER BR-5-0801 PUB DATE FEB 65
GRANT OEG-7-48-7670-203
EDRS PRICE MF-$0.25 HC-$1.60 38P.

DESCRIPTORS- *ENGLISH, *SPEECH COMPRESSION, *LISTENING SKILLS, *COMPREHENSION DEVELOPMENT, *COLLEGE STUDENTS, AURAL LEARNING, ORAL COMMUNICATION, LANGUAGE RESEARCH, TEACHING TECHNIQUES, SPEECH, SEX DIFFERENCES, EXPERIMENTAL GROUPS, AUDITORY PERCEPTION, TAPE RECORDINGS, STATISTICAL DATA

JUNE 1964 RESEARCH INDICATED THAT EXPOSURE TO TIME-COMPRESSED SPEECH COULD PRODUCE A SUBSTANTIALLY IMPROVED DEGREE OF COMPREHENSION, IN MALE COLLEGE STUDENTS, OF MATERIAL PRESENTED AT SPEEDS RANGING FROM 325 TO 475 WORDS PER MINUTE. AS AN EXTENSION OF ACTIVITIES DESCRIBED IN THE PROGRESS REPORT OF JUNE 1964, THE EXPERIMENT DESCRIBED HERE WAS DESIGNED (1) TO EXAMINE THE EFFECTS OF A SIMILAR PROGRAM ON FEMALE COLLEGE STUDENTS, AND (2) TO EXAMINE THE DIFFERENCE BETWEEN PRACTICE LISTENING SESSIONS CONTAINING NUMEROUS REST PERIODS AS COMPARED WITH UNINTERRUPTED LISTENING FOR LONGER PERIODS. THE NELSON-DENNY READING TEST WAS USED TO MEASURE READING COMPREHENSION, VOCABULARY, AND READING RATE, WHILE THE STEP LISTENING TEST WAS USED TO MEASURE NORMAL SPEED LISTENING SKILL. THE RESULTS GENERALLY CONFIRMED THE EARLIER FINDINGS THAT LOSS AT APPROXIMATELY DOUBLE NORMAL SPEED IS NOT VERY GREAT. THE MEAN LOSS WITH LITTLE TRAINING IS LESS THAN 20 PERCENT OF NORMAL SPEED SCORE. THERE WAS ALSO A SIGNIFICANT IMPROVEMENT IN MEAN SCORE ON A VERY HIGH SPEED PASSAGE REPEATED AFTER TRAINING. THE CONCLUSIONS WERE THAT MALE AND FEMALE SUBJECTS DID NOT DIFFER IN THEIR LISTENING COMPREHENSION PERFORMANCE, NOR DID MORE FREQUENT REST BREAKS IMPROVE PERFORMANCE. HALF OF THE REPORT CONSISTS OF CHARTS AND STATISTICAL DATA. (AUTHOR/BN)

ED014496

AMERICAN INSTITUTES FOR RESEARCH
WASHINGTON, D.C.

Address: 8555 Sixteenth Street, Silver Spring, Maryland 20910
Telephone: (301) 587-8201

PROJECT REPORT

Research on Speeded Speech as an Educational Medium

David B. Orr
Principal Investigator
and
Herbert L. Friedman

Sponsor

Title VII - National Defense Education Act of 1958
U. S. Office of Education
Department of Health, Education and Welfare
Grant No. 7-48-7670-203

Monitor

Joseph Murnin

February 1965

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

TE 500 006

ABSTRACT

The experiments contained in this report are essentially a continuation of the research reported in the June 1964 Progress Report. The research as a whole is an outgrowth of an increasing interest in the role of listening in education. It employs a new device, the Tempo-Regulator, which makes feasible the production of tape-recorded speech presented at much faster than normal rates without significant distortion of pitch.

In these experiments, as in the previous ones, the chief concern is with the effects of exposure to rapid connected discourse on the listening comprehension and reading skill of college students. A series of equated tests of comprehension on historical passages presented at normal speed and speeds ranging from 325 to 475 words per minute are used as the chief measure of listening comprehension. Practice material consists of four Talking Books compressed to the same speeds.

In addition the Nelson-Denny Reading Test was used to measure reading comprehension, vocabulary, and reading rate, while the STEP listening test was used to measure normal speed listening skill.

In addition to the general examination of the trainability of rapid speech comprehension, two major variables were investigated in this research: (1) the differences between male and female students in their abilities to learn to comprehend rapid speech; and (2) the differences between practice listening sessions containing numerous rest periods as compared with uninterrupted listening for longer periods.

The results generally confirm the earlier findings that loss at approximately double normal speed is not very great. The mean loss with little

training was less than 20% that of normal speed score. There was also a significant improvement in mean score on a very high speed passage repeated after training. Male and female subjects did not, in general, differ in their listening comprehension performance. The technique of providing frequent rest breaks did not improve performance over the earlier study in which there were fewer rest breaks.

Project Report

Grant No: 7-48-7670-203

Introduction:

While evidence suggests that thinking speed progresses at a more rapid rate than the rate of normal speech, until recently it has not been possible to increase the speed of tape recorded speech without introducing serious pitch distortion and consequent loss of intelligibility. With the development of the tempo-regulator which time-compresses speech while preserving the frequency characteristics of the remaining record, research has been undertaken by a number of investigators[1] and by the authors during the last two years into the variables associated with the comprehension of speeded speech, and the feasibility of training speeded speech listening skill.

Research to date has indicated that up to approximately double the rate of normal speech, listening comprehension of untrained subjects declines from 0 to 20%. With approximately 10 hours of exposure to rapid speech it has been possible to train subjects to comprehend speech at 425 wpm (or about three times normal rate) to a degree significantly better than a control group with much less exposure to rapid speech. There is also tentative evidence that exposure to rapid speech may be beneficial to reading comprehension.

It is expected that the fairly encouraging results obtained thus far with college students will create greater interest in this area, since rapid speech comprehension has great potential for education. The ability to present perhaps twice as much material in the same time; or, alternatively, the same amount of material in half the time, with little or no loss in comprehension is of vital interest at a time when the student needs to assimilate an ever increasing body of knowledge.

Purpose:

This experiment was undertaken as part of the extension of activities described in the Progress Report submitted in June 1964. The research then completed indicated that exposure to time-compressed speech could produce a substantially improved degree of comprehension, in male college students, of material presented at from 325 to 475 words per minute (wpm).

The experiment described here had two main goals: to examine the effects of a similar program of training on female college students; and to examine

---

[1] See Progress Report, June 1964.

one change in the general procedure; that of increasing the frequency of rest pauses during presentation of compressed speech.

The main hypotheses were:

1. There would be no difference in performance between male and female subjects.

2. The introduction of more frequent rest pauses would improve subject performance as compared with the earlier study.

In addition to these two new hypotheses, it was predicted that the major results of the earlier study would be borne out.

3. There would be little decrement at about double normal speed (325 wpm).

4. Comprehension of a 425 wpm passage after training would equal or surpass that of the experimental subjects in the earlier study (given subjects of initial ability equivalent to the earlier group).

5. Subjects would manifest a significant improvement in comprehension of a 475 wpm passage presented before and after training.

6. Subjects would show a significant rise in reading comprehension and speed as measured by the Nelson-Denny Reading Test (of which alternative forms were presented before and after training).

7. In addition it was felt advisable to test the hypothesis that listening ability at normal speed (as measured by the STEP Listening Test presented before and after training) would improve with compressed speech training since the negative results of the earlier studies were based on minimal evidence.

Experimental Design:

Because of the need to compare current results with those of the earlier study it was important to maintain the essential features of that study (with the exceptions of conditions for testing hypotheses 1 and 2, above) intact.

The major independent variable was again exposure to compressed speech. The major measures taken may be broken down into two types:

1. Those measures of reading and listening ability taken before and after training.

2. Specially constructed tests of listening comprehension presented during the training program.

The first type consisted of the Nelson-Denny Reading Test, and the STEP Listening Test for college freshmen. Both male and female subjects were divided into two equal groups. One form of the Nelson-Denny test (Form A) was given to one male and one female group before training; while the alternate (Form B) was given to the other male and female group before training. After

training, Form B was given to the first mentioned group, and Form A to the other group. Similarly, Parts One and Two of the STEP Listening Test were divided amongst the two groups so that those receiving Nelson-Denny A also received Part One of the STEP; and those taking Nelson-Denny B received Part Two of the STEP in the same session. (Note: one male subject accidentally received the same form of both tests before and after, thereby necessitating the elimination of his test scores from calculations).

The special listening material developed in the earlier study was again used here. That consisted of two types: practice and test materials. The practice material consisted of four tape-recorded novels each compressed to speeds of 325, 375, 425, and 475 wpm. Seven test passages were employed; each followed by a written multiple choice test of comprehension.

The purpose of the "books" was to provide practice in listening to progressively higher rates of speech; of the passages, to measure listening comprehension before, during, and after training. Before training all subjects listened to and were tested on one passage at "normal" speed (actually faster than normal at approximately 175 wpm) and one at very high speed (475 wpm). The purpose of the normal speed passage was to compare male with female listening ability on the type of material to be presented later, and to compare both with performance of the earlier study experimental subjects. The high speed passage was presented initially and repeated at the end of the experiment to measure improvement as a result of training. Two other new passages were presented after training to measure the degree to which listening skill would generalize to new material - one passage at 425 wpm and another at 325 wpm.

The measurement of performance during training posed special problems. Ideally, one would wish to have perfectly equivalent test material at each test speed; and a design which would counteract the possible effects of order of passage presentation. An attempt was made to achieve the equivalency of test material by a tryout at normal speed of five passages on a similar college population. This was done prior to the earlier main experiment. However, since the equation of the tests cannot be considered perfect it was necessary to consider a means of counterbalancing both content and the order of presentation of the different passages. A complete counterbalancing, however, was considered to be far beyond the scope of the experiment in its requirements for subject and experimental time.

In the earlier main experiment a compromise design was settled on in

which order of presentation and content of passages to be used was precisely balanced only for selected comparisons of Experimentals versus Controls. That is, at any given speed level the mean for Experimentals, and the mean for Controls would each be based on the same composition of test passages and the same orders of presentation of test passages. A further feature of the design was to require all subjects to take each of the test passages at normal speed (175 wpm) so that increments or decrements as compared to normal speed could in each case be based on the appropriate test base line. Three test passages (C1, C4, C5) were thus counterbalanced for the three speeds; 325, 375 and 425 (interchanged to 375(2)) words per minute. A fourth passage was presented to all subjects for the first time near the end of the experiment, and thus counterbalancing was not relevant. Finally, a fifth passage was taken by all subjects at the beginning and repeated again at the end of the experiment.

This procedure was followed during the earlier main experiment. In the current study both males and females are treated as "experimental" subjects. The earlier design was departed from in one respect during the current study. Because it was hoped to measure the retention of skill some time after the end of the experiment, it was decided to preserve one standardized passage for use as a new passage later. Another passage, taken from the same book with similar characteristics and recorded by the same person was substituted for it at 175 wpm. Unfortunately, an accident in mailing prevented it from reaching the experimenters in time to use it at higher speeds in the following three sessions. It then became necessary to use the original passage at those speeds. This meant that one-third of the subjects did not receive a repeated passage during the experiment proper. At each of the three above-mentioned weekly sessions, however, only one-ninth of the subjects were not receiving the repeated passage. While this is a departure from the intended design, it is felt that because of the distribution of subject and passage, it should not significantly reduce confidence in the results of the experiment. The experimental design is presented in summary form in Table 1.

It can be seen by examining this table that there are nine basic cells in the design, i.e., three tests by three orders of presentation (with the above noted exception that passages C5 and C6 are interchanged). The orders of presentation are rotated. This arrangement also has the characteristic of having one-third (minus one-ninth) of the cells at each speed up to 375 wpm repeating a test that had been used as the normal speed base line of that cell.

The existence of nine cells implied that the number of subjects should be

TABLE 1

PROCEDURE

Subjects:		MALES $A_1B_1C_1$ $D_1D_2D_3E_1E_2F_1F_2$ $G_1G_2H_1H_2H_3I_1I_2$	FEMALES $B_1B_2C_1C_2C_3$ $D_1E_1E_2F_1F_2$ $G_1G_2G_3G_4H_1H_2I_1I_2$
wpm	Test + Psg.	BIOGRAPHICAL DATA + AUDIOGRAM	BIOGRAPHICAL DATA + AUDIOGRAM
175	C	1 4 6 1 1 1 4 4 6 6 1 1 4 4 4 6 6	4 4 6 6 6 1 4 4 6 6 1 1 1 1 4 4 6 6
475(1)	C	3	3
Nelson-Denny (Form)		B B A B(B)B A B A A B B B A A A A	A A A A A B B A A A B B B B B B A A
Step (Form)		2 2 1 2(2)2 1 2 1 1 2 2 2 1 1 1 1	1 1 1 1 1 2 2 1 1 1 2 2 2 2 2 2 1 1
325		CHEAPER BY THE DOZEN	
325(1)	C	1 4 5	1 4 5
375		MIRACLE NEW YORK YANKEES	
375(1)	C	4 5 1	4 5 1
425		MAN-EATERS OF KUMAON	
		QUESTIONNAIRE	
375(2)	C	5 1 4	5 1 4
425/475		RUN SILENT, RUN DEEP THREE QUIZZES	
425(1)	C	2	2
475		RUN SILENT, RUN DEEP (LAST SECTION)	
475(2)	C	3	3
		DEBRIEFING QUESTIONNAIRE	DEBRIEFING QUESTIONNAIRE
325(2)	E	8	8
N-Denny(Form)		A A B A(B)A B A B B A A A B B B B	B B B B B A A B B B A A A A A A B B
Step(Form)		1 1 2 1(2)1 2 1 2 2 1 1 1 2 2 2 2	2 2 2 2 2 1 1 2 2 2 1 1 1 1 1 1 2 2

NOTE - Numbers in body of Table refer to passage numbers; ()Subject not used in analysis.

some multiple of nine. It was decided that since order effects might potentially be important, we would use two cases per cell as the closest approximation to the number of subjects specified in the proposal, thus giving us 18 males and 18 females. It was originally planned that if a subject should drop out, we would simply double the score in the cell to make up for his loss. However, further consideration led to the conclusion that individual differences were a greater source of variation than order effects, and it was decided that doubling would introduce more distortion than it would remove. Because of scheduling difficulties the females had no representation in cell A. Again, because of scheduling problems, other cells are over-represented. However, it should be remembered that each subject was exposed to the same number of passages at the same order of speeds.

Materials:

1. Equipment

The equipment used in this experiment which was conducted in a semi-soundproofed room consisted of the following (identical with that of the earlier main experiment):

a. A Magnecord 728-M tape recorder
b. Bogen AP-250 amplifier
c. Two Electro-Voice EV-2 speakers
d. Zenith A-200 Pure-Tone Audiometer and ancillary equipment.

2. Listening Materials

Six bench mark passages of approximately 3300 to 4000 words in length were selected and edited slightly to remove highly unfamiliar words and a few proper nouns. They were then recorded by the Talking Book studio of the American Printing House for the Blind and compressed at each of four speeds selected for use in this (and the previous) study: 325, 375, 425, and 475 wpm. Table 2 shows the characteristics of the individual passages which were designated C1, C2, etc. to C6. The mean listening grade of the edited material according to the Rogers formula was approximately 16.6; the mean reading ease according to the Flesch formula was approximately 66.5 (on a scale of 0 to 100 where 100 equals easy). The only change in these materials compared with the earlier study was the addition of passage C6.

The practice materials used were identical with those of the earlier study. They consisted of four full-length novels chosen from among those recorded by the Talking Book Library of the American Printing House for the Blind. The novels chosen for presentation were Cheaper by the Dozen, The "Miracle"

TABLE 2

Characteristics of Compressed Speech Passages

Passage	No.Words in Passage	No. Indep. Clauses	Avg.No. Wds.Not on Dale List/100[a]	No.Syl-lables p/100 w	Avg.No. Wds.per Sentence	Listen-ability[b] (grade level)	Reading Ease[c]	Duration in Minutes 175 wpm	325 wpm	375 wpm	425 wpm	475 wpm
C-1	3803	246	13.7	144	18	15.1	66	21.7	11.4	10.1	NA	NA
C-2	3515	205	11.5	137	22	15.1	68	NA	NA	NA	8.3	NA
C-3	3780	243	12.7	149	18	14.7	62	NA	NA	NA	NA	8.0
C-4	4039	220	16.3	141	18	18.3	69	23.1	12.4	10.8	NA	NA
C-5	4049	229	17.6	148	21	18.5	60	23.1	12.5	10.8	NA	NA
C-6	3320	188	16.0	140	13	17.7	74	19.0	NA	NA	NA	NA
Mean	3751.0	221.8	14.6	143.2	18.3	16.6	66.5	21.7	NA	NA	NA	NA

[a]Dale's long word list consists of 3000 familiar words employed in Rogers' listenability formula(see [b]).
[b]Grade level of material as determined by Rogers' listenability formula based on average sentence length and word familiarity.
[c]Measured by the Flesch formula for Reading Ease, where 0=hard, 100=easy.

New York Yankees, The Man-Eaters of Kumaon, and Run Silent, Run Deep.[2] (See Table 3). They were presented in that order at speeds of, respectively, 325, 375, 425, and 425/475 wpm.

One additional passage which had been used in an earlier exploratory study was also presented at the end of the experiment. The passage (E8) was presented at 325 wpm, contained approximately 1000 words and ran for about 6½ minutes. Listenability was 19.7 and reading ease, 48.6.

3. Test Materials

The reading test used was again the Nelson-Denny Reading Test, Forms A and B. This test was administered to both males and females both before and after the experiment as a measure of reading rate, vocabulary, and reading comprehension. Forms A and B were balanced for the two groups and, in each case, subjects took the alternate form the second time.

Listening comprehension tests based on the six selected bench mark test passages were developed especially for this study. For the five passages used in the earlier study, two consultants, each independently wrote 30 five-option multiple choice items. These items were edited and assembled into a tryout form by the staff. All five tests were administered to the same sample of approximately 35 freshman and sophomore students at the University of Maryland. Based on these results the tests were item analyzed for difficulty and item-test correlations. Twenty-five questions each were selected for passages C1, C4 and C5, and 30 questions each for passages C2 and C3. The test for C6 (developed independently) consisted of 25 items. In each case, the item statistics were distributed and an effort was made to balance the tests, both in terms of type of content and in terms of the item statistics. It is felt that the rough equation of these tests by means of item analysis combined with the fact that each of the passages was selected from the same book and the same author has resulted in five effectively comparable tests. Further, any lack of comparability in tests C1, C4, and C5 was balanced out by the experimental design described above. A summary of the item statistics for the five tests is presented as Appendix A6.

Test items for the Pretest Study passage E8 had been written and developed by the project staff and cannot be considered to be either equated among themselves or specifically comparable to the C passages. Nevertheless, it was used at the end of the experiment. It's limitations should be kept in mind

---

[2]Used by kind permission of the publishers. Reference - Bibliography. Characteristics given in Table 3.

TABLE 3

Characteristics of Compressed Speech Books[a]

Book	Estimated Total No. Words	Estimated Speed of Presentation(wpm)	Estimated Duration	Estimated Reading Ease	Estimated Listenability
Cheaper by the Dozen	65,300	325	3.35 Hours	85	9.5
The "Miracle" New York Yankees	53,500	375	2.75 Hours	72	9.9
Man-Eaters of Kumaon	81,900	425	3.21 Hours	62	16.5
Run Silent, Run Deep	117,300	425,475	4.41 Hours	62	13.2

(a) Figures are based on a 5-10% random sample of each book.

in interpreting those results.

In addition to the above materials, four questionnaires calling for subjective evaluation of performance were presented during the course of the experiment along with several essay type quizzes based on the material presented in the novel Run Silent, Run Deep. A final debriefing questionnaire was presented at the end of the experiment proper. This questionnaire called for an extensive subjective judgment of listening conditions, performance, application, etc.

Procedure:

As may be seen from the table showing the design for the experiment proper, males and females received identical treatment. At the first session, all volunteers were gathered together and administered the Nelson-Denny, either Form A or Form B, the STEP Listening Test, Part One or Part Two, a normal speed base line passage, C1, C4 or C6 at 175 wpm, and a high speed base line passage, C3 at 475 wpm.

The first week of the experiment required Experimental subjects to come in for two sessions of more than an hour each to listen to Cheaper by the Dozen, presented at 325 wpm. They returned on Friday of the same week to listen to a final section of Cheaper by the Dozen followed by a bench mark test passage at 325 wpm. The single major change in procedure as compared with the earlier study was instituted with the beginning of practice listening. At approximately 10 minute intervals, as near to a natural break in the material as was feasible, the playback of the novels was halted. The subjects were instructed not to talk and to attempt to recapitulate what they had just listened to. During the break, subjects were permitted to go to the water cooler, lavatory, or just get up and stretch. The mean duration of the presentations between breaks for the four novels was as follows: Cheaper by the Dozen, 11' 45"; The "Miracle" New York Yankees, 9' 45"; Man-Eaters of Kumaon, 9' 55", Run Silent, Run Deep, 10' 58". The week following that, subjects listened to The "Miracle" New York Yankees at 375 wpm during the week and took the bench mark test passage on Friday of that week.

During the third experimental week, The Man-Eaters of Kumaon was presented at 425 wpm according to the same schedule and the bench mark test was administered to both Controls and Experimentals on Friday again at 375 wpm. (The decision to administer this bench mark passage at a speed slower than the practice session was made in the earlier experiment in an effort to find out whether or not a slight drop-back in speed might produce an increment in

performance by making the test material seem easy as compared to the practice material. This procedure was preserved here.)

During the final week of the original experiment, it had been decided that some alteration in procedure would take place. In each session subjects listened to part of Run Silent, Run Deep at 425 wpm and the final part at 475 wpm. (It was originally planned to present the entire book at 475 wpm.) In addition, they were required to complete brief essay tests at the close of each practice listening session. The rationale for this was that as the speed level goes up, so does the concentration necessary to follow the material. The testing device was employed to maintain incentive and involvement to a high degree. Again, this procedure was employed in the current study.

Since Run Silent, Run Deep is a substantially longer book, it was necessary to have three sessions during the week in order to finish up with a short session on Saturday morning. After the completion of Run Silent, Run Deep on Saturday morning, all subjects received a brand new passage (C2), which none had heard before, at the speed of 425 wpm and took a test on this passage. They also received for the second time, the original high speed base line passage (C3) at 475 wpm.

Subjects also received one of the Pretest Study passages (E8) at 325 wpm to test their ability to comprehend a modestly speeded passage after the practice sessions.

Finally, a debriefing questionnaire calling for subjective reactions to the experiment was completed by all subjects.

The final stage of the procedure, of course, consisted of scoring, tabulating and statistical analyses.

Findings

This experiment had two primary goals: (1) to compare the performance of male with female subjects and (2) to measure the effects on listening comprehension of rapid speech with an increased number of short breaks during practice, as compared with the Spring 1964 study.

1. Comparison of male and female subjects:

A comparison of mean listening test comprehension scores (Table 4) by independent T tests showed no significant difference at any point between male and female subjects (see Table 5).

A comparison of mean decrement from normal speed to each of the other speeds between male and female also showed no significant differences (see Table 6). (While a measure of male performance showed no significant

TABLE 4

Means and Standard Deviations on Prorated Listening Scores of Males and Females by Speed and for Speed Comparisons

	Test[a] (in wpm)	Male		Female	
		M	SD	M	SD
Initial Test	175	14.1	5.97	13.9	4.74
Initial Test	475(1)	4.3	3.08	3.4	2.80
After 1st week practice at 325 wpm	325(1)	11.6	5.38	11.5	5.66
After 2nd week practice at 375 wpm	375(1)	9.7	5.23	11.1	4.99
After 3rd week practice at 425 wpm	375(2)	11.3	5.58	10.9	4.23
After 4th week practice at 425/475 wpm	425	8.2	4.85	7.7	3.58
Post-Test	475(2)	6.3	3.46	7.2	2.97
Post-Test	325(2)	10.6	7.12	11.4	6.25

Note - N = 17 for males, N = 18 for females
[a]In order of presentation

TABLE 5

Significance of Differences Between Means
Of Prorated Listening Scores for Males and Females by Sex

Test Speed (wpm)	Mean Male Score	Mean Female Score	Male - Female Mean Difference	Significance
175	14.1	13.9	-0.2	NS
325 (1)	11.6	11.5	-0.1	NS
325 (2)	10.6	11.4	+0.8	NS
375 (1)	9.7	11.1	+1.4	NS
375 (2)	11.3	10.9	-0.4	NS
425	8.2	7.7	-0.5	NS
475 (1)	4.3	3.4	-0.9	NS
475 (2)	6.3	7.2	+0.9	NS

NOTE - N = 17 for males, N = 18 for females

TABLE 6

Significance of Differences Between Means Of
Prorated Listening Scores for Males and Females by Speed Comparisons

Comparison between tests (wpm)	Mean Differences		Significance of Differences Male vs. Female
	Male	Female	
175-325 (1)	-2.4	-2.4	NS
175-325 (2)	-3.5	-2.5	NS
175-375 (1)	-4.4	-2.8	NS
175-375 (2)	-2.8	-3.0	NS
175-425	-5.9	-6.2	NS
325 (1)-375 (1)	-2.0	-0.4	NS
375 (1)-375 (2)	+1.6	-0.2	NS
375 (2)-425	-3.1	-3.2	NS
475 (1)-475 (2)	+2.0	+3.9	NS

NOTE - N = 17 for males, N = 18 for females

Figures may not agree precisely with those in Table 4 due to rounding error

decrement from normal speed to 325(1), and the mean female scores do show a significant decline, analysis of the differences between males and females does not reach significance).

An analysis of the change in performance during successive weeks (with increasing speeds) also showed no significant differences between male and female subjects. The same held true for the increment in performance on the repeated high speed passage presented at the end of the experiment.

These results taken together suggest that there was not a difference between the men and women subjects of college age in learning to comprehend speeded speech under these conditions.

The Nelson-Denny Reading Test, administered before and after the experiment, does show differences between male and female subjects (see Table 7). Male subjects did not show any significant improvement in mean vocabulary, comprehension or total score; but they did significantly increase their mean reading rate (from 402 to 531 wpm). Female subjects, on the other hand, showed significant mean improvement on each of the four above-mentioned measures for the Nelson-Denny (including reading rate which rose from 331 to 389 wpm). The increment in total score (comprised of Vocabulary and Comprehension) was significantly greater for females than for males. The increment in reading rate, however, was significantly greater for males. Nevertheless, the improvement in reading rate did exist for both male and female subjects. It is further attested to by the fact that both groups showed a significant rise in the mean number of the last item attempted on both the Vocabulary and Comprehension tests.

The STEP Listening Test (Table 7), presented at normal speeds both before and after the body of the experiment, showed no significant mean change for either the male or female group.

Discussion:

It was hypothesized that no significant differences were likely to be found between male and female trainability on compressed speech. This seems to have been borne out in this experiment. The results of the reading test, however, suggest that there might be some differences in this area. On closer examination, however, the differences become more tenuous. The differences in mean increment on both Vocabulary and Comprehension between male and female subjects did not achieve significance. A look at the following table which shows the number of subjects of both groups whose scores rose or fell between the pre- and post-administration of the reading test

TABLE 7

The Significance of Differences Between Mean Nelson-Denny Scores, Last Item Attempted, and STEP Listening Test Scores On Tests Administered Before and After Training

Nelson-Denny Score	Males		Females		Significance Of Mean Differences		
	1st Adm	2nd Adm	1st Adm	2nd Adm	1st vs 2nd Adm		Comparison of Mean Differences Male vs Female
	Mean	Mean	Mean	Mean	Male	Female	
Vocabulary[a]	54.2	55.0	57.9	62.7		P<.01	
Comprehension[a]	51.9	50.9	52.7	57.8		P<.05	
Total Score[a]	106.1	105.9	110.8	120.6		P<.01	P<.05
Reading Rate	402.3	531.3	330.8	389.4	P<.01	P<.01	P<.05
Last Item Attempted(Vocab)	73.3	85.0	73.8	83.6	P<.01	P<.01	
Last Item Attempted(Comp)	34.6	36.0	33.4	35.1	P<.01	P<.05	
STEP Listening Test[a]	312.1	310.6	313.5	313.4		---	

NOTE - Calculations carried to greater accuracy than indicated. Totals may not agree due to rounding error.

[a]Corrected for guessing.

suggests that the differences between the groups were not highly conclusive.

Nelson-Denny	Number of Subjects Showing Increment		Number of Subjects Showing Decrement	
	Male	Female	Male	Female
Vocabulary	9	12	5	6
Comprehension	7	12	7	5
Total Score	10	15	5	3
Reading Rate	15	15	1	3

The sharp rise in reading rate for both groups duplicates the findings of the Spring 1964 experiment in which both Experimental and Control subjects showed a significant rise in mean reading rate. The fact that Control subjects improved their reading scores of course throws some doubt on the efficacy of rapid speech listening per se for improving reading rate; however, it should be remembered that by the end of the experiment, the Control subjects did have about two hours of speeded speech listening, under conditions requiring close attention. The finding that reading rate improves with exposure to rapid speech remains a tenuous one, however.

It remains something of a puzzle as to why subjects who do demonstrate improvement in their abilities to comprehend rapid speech, should show no significant change in performance on a normal speed standardized listening test (the STEP Test). Of course, part of the learned skill is recognizing high speed speech sounds - a skill which would not carry over to normal speed listening which is essentially 100% intelligible. Part of the learned ability may be the ability to process the material that is heard more rapidly; again, that skill is essentially unnecessary in normal speed listening where there is usually ample time to fully comprehend the meaning of the discourse (assuming the subject is capable of it). One would, however, expect an improvement in the ability to organize material, to carry over into the normal speed situation, but that is a task for further research.

Summary of Comparison of Male and Female Subjects:

The overall picture shows no significant difference in mean performance on tests of listening comprehension based on high speed speech between groups of male and female subjects roughly equated for listening abilities, age, and level of education at the start of the experiment.

There are no differences in performance before or after training on the STEP Listening Test.

There is some evidence that women improved more in mean total Nelson-Denny Reading Test score (consisting of Comprehension and Vocabulary tests) while males improved more in mean Reading Rate score.

2. Comparison of Present Study with Spring Group

The chief differences between the current study and the Spring group (apart from the sex of one-half of the subjects) lay in the scheduling of breaks (rest periods) during exposure to the practice material (compressed novels). While in the Spring the Experimental subjects received a break in listening for approximately five minutes during a 1½ hour presentation, the current subjects were given three minute breaks approximately every 10 minutes. In all other essential respects treatment was identical. Section 1 of this report suggests that male and female scores on listening comprehension may be combined as they do not differ significantly and this will be done to afford a better comparison of the Autumn with the Spring study. Table 8 summarizes the percent of the initial normal speed (175 wpm) passage achieved by subjects at higher speeds in the current study and in the Spring 1964 study. It also includes mean initial high speed and mean initial Reading Test scores.

The table reveals that on every measure following training (save one - the test and passage at 325 (2) (which was unstandardized and of uneven quality), the Spring Experimentals did best, followed by the Autumn male and female subjects, followed by the Spring Control subjects (who did not receive practice exposure). There is also a tendency present for the gap between male and female, and controls to widen as the experiment progresses. (See Fig. 1)

These results suggest two things: (1) The practice schedule employed in the Spring was more effective in the training of listening to rapid speech. (2) With more extensive training the effects of practice under the poorer schedule might achieve results equivalent to the better schedule.

Nelson-Denny and STEP scores were also examined for correlations (all positive) between first and second administration for male and female subjects as compared with the experimental and control subjects of the earlier study. (See Table 9)

In general, the correlations are high, approaching the alternate form reliabilities of the Nelson-Denny (no data is available for the STEP Test which was not designed as an alternate form test as used here). There are some exceptions, however. The correlation for female subjects on reading

TABLE 8

Mean Scores and Mean Performance by Speed as a Percentage
Of Mean Performance at Normal Speed

Test Speed (wpm)	Male and Female Combined		Spring 1964 Experimental		Spring 1964 Control	
	Mean Score	Percentage	Mean Score	Percentage	Mean Score	Percentage
Nelson-Denny Total[a]	108.5	---	112.3	---	110.2	---
175[a]	14.0	100.0	15.7	100.0	17.4	100.0
475(1)[a]	3.8	27.5	4.2	26.8	6.2	35.6
325(1)	11.5	82.5	14.1	89.2	13.9	79.9
375(1)	10.4	74.4	13.6	86.6	12.9	74.1
375(2)	11.1	79.2	13.6	86.6	13.1	75.3
425	8.0	56.8	12.2	77.7	8.6	49.4
475(repeated)	6.8	48.2	8.8	56.0	6.8	39.1
325 (post exp.)[b]	11.0	78.6	17.2	109.5	16.0	92.0

[a]Prior to Training.

[b]Unstandardized passage and test.

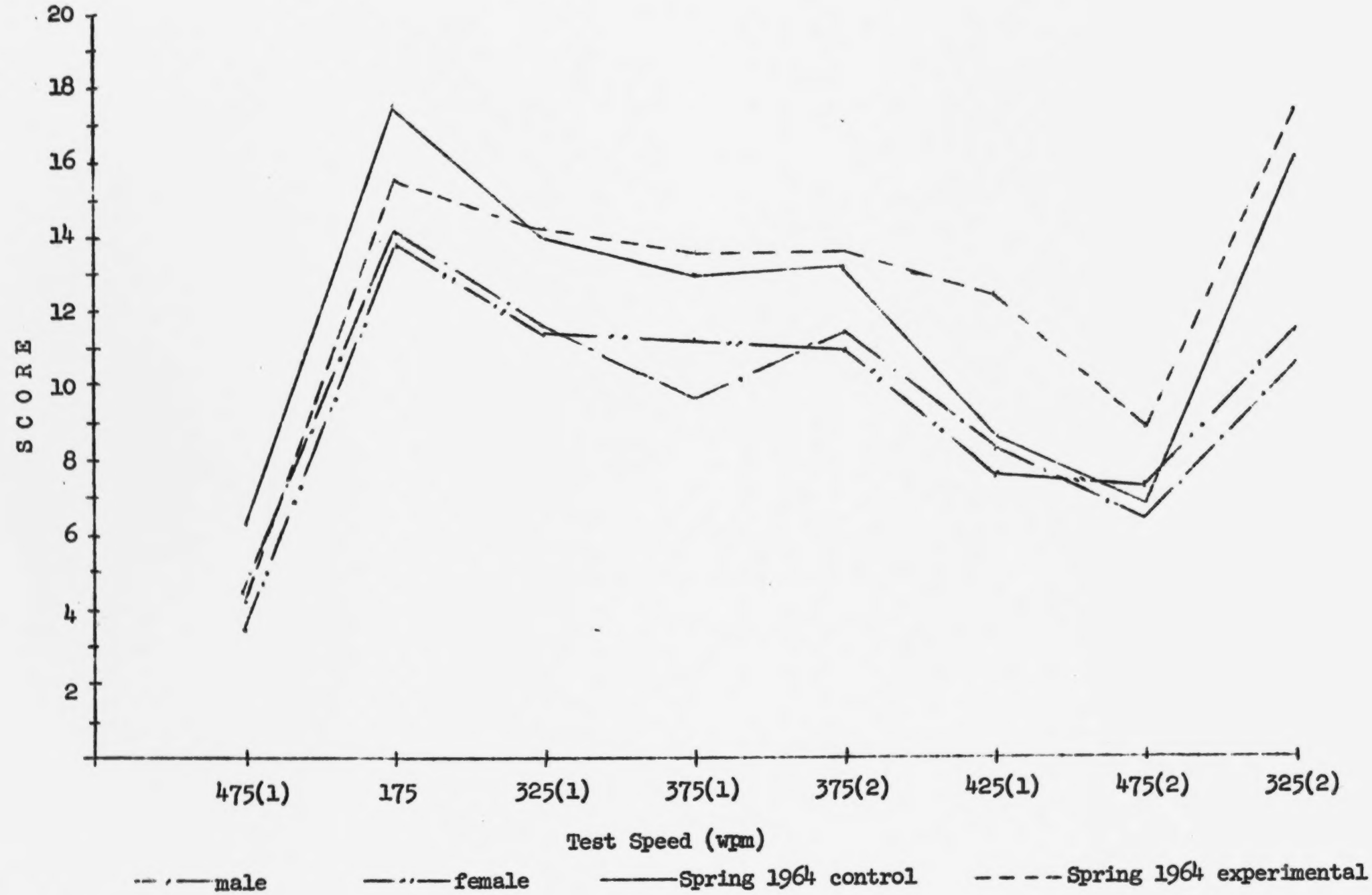

Fig. 1. A comparison of mean scores on tests following presentation of historical material at speeds ranging from 175 wpm to 475 wpm. Experimental (Spring) subjects had 1-1/2 hour practice sessions with one break. Controls (Spring) - no practice. Males and Females, 3-minute breaks.

TABLE 9

Reliability Coefficients

Subjects		Nelson-Denny Reading Test				STEP Listening Test
		Vocabulary	Comprehension	Total	Reading Rate	
Autumn 1964	Male	0.86	0.63	0.84	0.71	0.85
	Female	0.88	0.55	0.86	0.53	0.43
Spring 1964	Experimental	0.88	0.71	0.93	0.85	----
	Control	0.89	0.47	0.83	0.77	----
Standardizing Population[a]		0.93	0.81	0.92	0.93pre-train. 0.82post-train.	

NOTE - Scores corrected for guessing before calculating coefficients.

[a]Coefficients taken from Nelson-Denny Manual.

rate is substantially lower than that of males.

Repetition

The repetition of some passages for two-thirds of the subjects during the training period suggest, as in the previous study, that repetition is beneficial to comprehension (see Table 10). However, the number of subjects involved can make this at best only a suggestive finding.

Intercorrelations:

It was felt that the similarity of result between male and female subjects warranted the combining of those results in an examination of correlations between speeds of presentation and Nelson-Denny test scores (see Table 11).

A comparison of the normal speed presentation with higher speeds suggests that as speed of presentation goes up, correlation between normal speed performance and higher speed performance declines. The exception to this is the correlation between 175 and 475(2), however, there an additional factor is involved, the repetition of a passage heard before. Repeating a passage leads to greater familiarity with the speech sounds. Moderately speeded speech is also more familiar to the subject than is high speed speech. That may account for an upturn in the correlation between high speed speech which has been repeated as compared with those which are not repeats.

For both current subjects and experimental subjects in the earlier study, there was a greater correlation between normal speed score and the second administration of the high speed passage than for normal speed score and the initial presentation of the high speed passage. Again, this suggests a growing ability to handle the high speed speech in the manner they are accustomed to handling normal speed speech. To the extent these correlations at high speed are not higher, it is possible that the training of rapid speech listening skill is deficient. This assumes, of course, that the same underlying ability is common both to normal speed and high speed listening and while, to some extent, this must be true, the extent of it is not yet clear.

There is also something of a tendency both for current and Spring subjects for progressively higher speeds (unrepeated passages) to correlate less and less well with total score on the Nelson-Denny (which consists of comprehension and vocabulary scores). Again, this suggests that an underlying factor of language handling ability may be predominantly involved. Reading Rate scores, which are highly dependent on the speed factor, do not show

TABLE 10

Mean Change in Score for Subjects Repeating
and Not Repeating Passages by Speeds

Speeds Compared (wpm)	Non-Repeats				Repeats				Time Elapsed (in weeks)
	Male	N	Female	N	Male	N	Female	N	
175-325(1)	-3.51	14	-2.67	16	+2.53	3	-0.7	2	1
175-375(1)	-5.61	14	-4.42	12	+1.20	3	+0.3	6	2
175-375(2)	-4.31	11	-4.11	15	-0.2	6	+2.4	3	3
475(1)-475(2)	-----	--	-----	--	+2.02	19	+3.86	18	4

TABLE 11

Selected Intercorrelations of Reading and Listening Performance for Combined Male-Female (N = 34) and Spring 1964 Experimental (N = 16) Groups

Test Speed		175	325(1)	425(1)	475(1)	475(2)	Nelson-Denny Total	Nelson-Denny Reading Rate
175		----	0.65 0.79	0.53 0.69	0.36 0.37	0.50 0.40	0.43 0.79	0.47 0.28
325(1)			----	0.57 0.84	0.27 0.15	0.59 0.41	0.48 0.66	0.47 0.17
425(1)				----	0.52 0.21	0.50 0.35	0.29 0.50	0.38 0.06
475(1)					----	0.46 0.79	0.44 0.31	0.31 0.33
475(2)						----	0.45 0.55	0.34 0.47
NELSON-DENNY	Total						----	0.30 0.44
	Reading Rate							----
Xe		14.0 15.7	11.6 14.0	8.0 12.2	3.8 4.2	6.8 8.8	108.6 112.3	364.5 338.6
Se		5.29 4.64	5.44 6.76	4.19 4.30	2.93 2.03	3.16 2.64	20.09 25.49	102.22 116.80

NOTE - First entry in each cell is combined Male-Female data; second entry is Spring 1964 experimental group data.

such a marked trend.

Results of Questionnaires and Quizzes:

The quizzes given during the fourth training week (intended to increase motivation and involvement with the listening material) give evidence of generally superior performance by the Spring Experimental subjects compared with the current groups. Unlike the listening tests based on the passages, there is evidence that the Autumn male subjects are doing better than female subjects. The subjective ratings made by the subjects suggest that the topic of the book on which the quizzes were based (submarine warfare) was of greater interest to the males than to the females.

The mean quiz scores achieved over the three sessions by the Spring Experimentals, Autumn males, and Autumn females, respectively, are as follows: 65.0%, 43.0%, and 31.3%. The mean subjective estimates of percent of words which were intelligible are: 73.5, 69.2 and 56.0%. The mean subjective estimates of percent of story understood are: 78.0, 68.2, 57.2%. It should be noted that the decreased scores of the current subjects are in small part attributable to the increased frequency of late arrivals among both males and females for the practice sessions. A ranking of the three groups on each of the 11 measures taken (3 quizzes, 4 word estimates, and 4 story estimates) show a mean rank for the Spring, male and female subjects, respectively as: 1.04, 2.04 and 2.91.

The overall results confirm the superiority of the Spring group over both male and female subjects of the Autumn study. A comparison of the "distance" between male and Spring subjects, and male and female subjects, suggest that while actual male performance on the quizzes were nearer the females than the Spring groups, male estimates of their own performance placed them nearer the Spring group. This lends some weight to the hypothesis that the superiority of male performance over female is primarily a matter of greater interest in the practice material.

There is, in general for all three groups, a superior performance, and higher subjective estimate, at 425 wpm than at 475 wpm.

During the third week of training subjects were given a brief questionnaire. All current and Spring subjects felt they were making some progress in listening to rapid speech. Most subjects felt they were doing better with the practice book(Man-Eaters of Kumaon) than in the preceding session. The Spring, Autumn male and Autumn female subjects estimated the percent of words which were intelligible to them as, respectively, 75, 73 and 65. Estimates of per cent of story understood were, respectively, 78, 81 and 67. There is the suggestion that females were doing less well than the males of both groups - possibly as a result of lesser interest.

Debriefing Questionnaire

At the end of the fourth and last week of the experiment all subjects were given a debriefing questionnaire to complete. Subjects were required to describe their reactions, evaluate the experiment, and make any other comments they felt were relevant.

The great majority of Autumn subjects (as was true in the Spring) indicated that the most significant aspect of the experiment to them was their increased ability to comprehend rapid speech. Nearly all agreed that more practice would be beneficial.

One of the points of difference between Autumn and Spring subjects (a matter of degree) was a lesser interest among the Autumn subjects in the content of the practice material. Part of this was undoubtedly attributable to the presentation of material which was of greater masculine interest, to female subjects.

On other measures there was general agreement with the Spring subjects: An outline of the passage to be read beforehand was generally thought of as the most potentially helpful device. A copy of the text to be read simultaneously, and a list of key words were also rated highly.

Some subjects felt that laboratory conditions could be improved by greater isolation of subjects (earphones or booths), better ventilation, more comfortable chairs, etc.

It was generally agreed that the most difficult aspect of the experiment was maintaining attention, particularly during the less interesting practice books. Subjects indicated that attention wandered most often during the latter part of a session, during presentation of material at the higher speeds, and when subject matter was boring.

A key difference in the Autumn study was the introduction of three-minute breaks approximately every ten minutes. Two-thirds of the subjects felt that the occurrence of the breaks was about right, while a little less than a third thought they were too frequent. There was some complaint about the occurrence of breaks in other than natural pauses in the story.

In general agreement with the Spring subjects, more than one-half of the current group felt that they heard long words better than short ones. They also singled out proper names, frequently repeated words. Many cited features of prosody such as stress, pitch, and juncture as being crucial in comprehension at higher speeds.

Summary of Results and Implications

Of the two major predictions made, one was confirmed, the other was not. As predicted, it is generally true that male and female subjects did not differ significantly in their abilities to be trained to comprehend rapid speech. The introduction of more frequent breaks during practice sessions did not, contrary to the prediction made, improve performance and may, in fact, have detracted from the training program as compared with the Spring study.

Two factors must be considered, however, which may weaken the conclusion that the new practice schedule was actually detrimental. The first is that both male and female subjects are inferior in initial listening ability to both the experimental and control subjects of the Spring study. (See Fig. 1.) The shape of the curves depicting performance at the various speeds of presentation is very similar for all four groups. Male and female performance is very close together, and both are below that of the Spring subjects. Control subjects who started off at a substantially higher comprehension level on both normal speed and high speed initial measures of listening ability in general maintain their superiority over the current subjects, although they had much less practice.

This leads to the other factor involved. No effort was made to segregate male and female subjects during experimental sessions (for scheduling reasons it was virtually impossible). To some extent it is felt that the combination of frequent breaks in presentation together with the presence of mixed sexes of college freshman age, in a highly novel situation (listening to speeded speech) substantially detracted from the degree of concentration necessary for satisfactory training. Until sufficient familiarity with speeded speech listening is established, it may be advisable to provide greater subject isolation in the training period.

While the listening results in general are inferior to that of the Spring group, there were many encouraging results which confirmed other hypotheses. Both male and female subjects showed a significant increase in mean score on the high speed (475 wpm) base line passage when repeated after training. Male subjects showed no significant decrease from normal speed score after a week's training at 325 wpm. Female subjects showed no significant decrease from normal speed to a 325 wpm passage after training was completed. Neither male nor female subjects showed decline in performance from 325 to 375 wpm.

While rapid speech training did not significantly improve normal speed listening performance as measured by the STEP test, both males and females showed a significant increase in reading rate (as measured by the Nelson-Denny Reading Test). Female subjects also showed a significant increase in reading comprehension.

The subjective evaluations of the subjects themselves is also, in general, encouraging. Most subjects felt they were learning to comprehend

rapid speech. Most subjects felt that the technique of rapid speech would be useful in the educational situation. Most subjects also felt that they would benefit from more training.

The results of this study together with that of the Spring study suggest two things of major importance: College students are capable of being trained to comprehend lecture-type material presented at from 2 to 3 times normal speed; training in rapid speech listening will improve reading rate, and may also improve reading comprehension.

Much work remains to be done. Among the variables which remain, it is planned to examine the following:

1. The retention of rapid speech listening skill after training.
2. The retention of the content of material which has been learned by rapid speech presentation.
3. The use of various listening aids both in training and in listening by trained subjects, including the following:
   a. an outline of material to be heard.
   b. a list of key words.
   c. greater visual and auditory isolation.
   d. establishing familiarity with the sound of crucial words when compressed.
4. The types of material amenable to speeded speech presentation.
5. The use of compressed tapes as a review technique.
6. The degree to which both reading and listening ability may be enhanced by the simultaneous presentation of controlled rate auditory and visual material.

It is felt that significant progress is being made in the evaluation of speeded speach as an educational medium.

APPENDIX A1

Final Prorated Listening Scores by Subject and Rate of Presentation
Male Subjects

Words p/min	A 1	B 1	C 1	D 1	D 2	D 3	E 1	E 2	F 1	F 2	G 1	G 2	H 1	H 2	H 3	I 1	I 2	MEAN	SD
175	7.5	18.8	20.6	21.2	6.2	21.2	1.2	12.5	17.7	19.9	8.8	18.8	15.5	14.0	10.8	9.6	14.8	14.1	5.97
475(1)	3.3	10.4	7.7	7.5	0.6	7.5	2.5	7.3	2.1	5.2	0.0	4.4	4.6	0.0	3.8	0.8	4.8	4.3	3.08
325(1)	10.0 (R)	21.2	10.8	20.0	7.5	23.8	8.8 (R)	10.0 (R)	6.8	13.8	6.2	12.0	12.0	11.5	9.0	10.0	4.2	11.6	5.38
375(1)	10.0	20.0 (R)	5.5	16.2	2.5	12.5	7.5	3.8	3.0	12.5	12.5 (R)	17.5 (R)	11.0	8.2	3.8	6.5	11.2	9.7	5.23
375(2)	6.2	15.0	8.8	21.5 (R)	5.0 (R)	26.2 (R)	5.8	8.8	4.5	13.8	6.2	16.2	12.5 (R)	18.5 (R)	10.0 (R)	10.0	7.5	11.3	5.58
425	3.3	14.0	5.2	15.8	1.0	17.7	6.2	5.2	8.5	9.4	2.5	12.5	7.1	6.5	12.5	3.5	8.3	8.2	4.85
475(2)	5.6	9.0	8.1	12.7	6.5	9.6	4.4	2.1	8.5	10.4	0.0	8.3	6.7	0.8	3.1	5.6	5.4	6.3	3.46
325(2)	9.4	22.4	12.0	19.8	12.5	14.6	1.6	1.6	0.0	14.6	1.6	19.8	17.2	13.5	6.8	4.2	9.4	10.6	7.12

NOTE - The test scores are corrected for chance, prorated to a base of 25 items per test, (all 425 and 475 tests were 30 items; 325(2) was 12) and rounded to one decimal place.
(R) = Repeated Passage

APPENDIX A2

Final Prorated Listening Scores by Subject and Rate of Presentation
Female Subjects

Words p/min	B'1	B'2	C'1	C'2	C'3	D'1	E'1	E'2	F'1	F'2	G'1	G'2	G'3	G'4	H'1	H'2	I'1	I'2	MEAN	SD
175	5.0	19.2	12.6	15.6	15.8	17.5	22.5	20.8	16.3	15.6	8.8	10.0	15.0	17.5	8.0	11.8	8.9	10.5	13.9	4.74
475(1)	2.1	6.5	1.2	0.0	2.3	1.7	4.8	1.9	0.0	0.0	3.1	4.2	8.3	5.2	0.0	4.4	7.1	7.9	3.4	2.80
325(1)	7.5	16.5	11.5	19.0	14.2	12.5	23.8 (R)	17.5 (R)	12.5	3.8	10.5	10.8	11.5	12.5	6.8	10.0	0.0	5.8	11.5	5.66
375(1)	6.2 (R)	17.5 (R)	9.0	10.0	10.0	5.0	18.2	9.5	6.8	11.2	11.2 (R)	10.0 (R)	11.2 (R)	21.2 (R)	10.5	7.5	4.2	20.0	11.1	4.99
375(2)	7.0	12.8	15.2	6.5	7.8	19.0 (R)	20.0	13.0	8.8	12.5	5.0	8.8	7.5	11.2	12.5 (R)	13.0 (R)	6.8	9.0	10.9	4.23
425	7.5	13.8	11.7	4.4	8.8	5.6	8.8	5.0	6.2	5.2	5.2	10.4	12.7	12.5	3.8	11.0	2.1	4.2	7.7	3.58
475(1)	8.5	11.9	8.3	5.8	5.6	6.5	14.4	8.3	6.2	0.6	9.4	6.2	8.3	6.2	4.2	7.7	7.1	5.0	7.2	2.97
325(2)	6.8	12.0	4.2	14.1	10.4	9.4	22.4	14.6	17.2	12.0	12.5	4.2	19.8	6.8	0.5	18.2	3.1	17.2	11.4	6.25

NOTE - The test scores are corrected for chance, prorated to a base of 25 items per test, (all 425 and 475 tests were 30 items; 325(2) was 12) and rounded to one decimal place.
(R) = Repeated Passage

APPENDIX A3

First and Second Administration Scores[a] of the Nelson-Denny Reading Test and Last Item Attempted for Male Subjects (N=16)

Subject	Vocabulary				Comprehension				Total[c] Score		Reading Rate	
	1st Score	L.I.A.[b]	2nd Score	L.I.A.	1st Score	L.I.A.	2nd Score	L.I.A.	1st	2nd	1st	2nd
A_1	57	75	61	87	58	34	57	36	115	118	290	491
B_1	70	85	68	100	57	36	60	36	127	127	413	697
C_1	58	95	62	92	57	36	54	36	114	116	426	586
D_1	74	81	78	90	52	36	54	36	126	132	488	600
D_3	74	81	75	89	60	36	70	36	134	145	758	1095
E_1	39	50	40	71	42	27	42	36	80	82	287	391
E_2	58	83	60	91	40	36	40	36	98	100	391	578
F_1	50	69	65	86	54	36	55	36	104	120	371	425
F_2	81	99	71	99	57	36	64	36	138	136	338	327
G_1	32	65	32	76	40	36	34	36	72	67	299	491
G_2	33	54	39	55	52	36	50	36	85	88	511	524
H_1	43	67	50	100	48	34	60	36	92	110	438	563
H_2	51	76	49	87	56	35	38	36	108	87	456	524
H_3	50	60	39	73	50	35	32	36	100	71	275	344
I_1	46	69	46	100	64	36	54	36	111	100	446	461
I_2	51	61	45	64	44	28	50	36	94	95	250	403
Mean	54.2	73.3	55.0	85.0	51.9	34.6	50.9	36	106.1	105.9	402.3	531.3

[a]Corrected for guessing.
[b]Last item attempted.
[c]Totals may not add because of rounding error.

APPENDIX A4

First and Second Administration Scores[a] of the Nelson-Denny Reading Test and Last Item Attempted for Female Subjects (N=18)

Subject	Vocabulary				Comprehension				Total[c] Score		Reading Rate	
	1st Score	L.I.A.[b]	2nd Score	L.I.A.	1st Score	L.I.A.	2nd Score	L.I.A.	1st	2nd	1st	2nd
B_1'	52	89	48	81	40	36	60	36	92	107	287	299
B_2'	53	63	63	76	52	30	60	36	106	122	407	450
C_1'	45	72	40	96	46	33	52	36	92	93	309	403
C_2'	54	66	70	84	55	36	52	36	109	122	262	368
C_3'	68	77	78	90	62	36	62	36	130	140	309	425
D_1'	49	50	44	66	52	36	62	36	101	106	327	513
E_1'	91	100	92	100	67	36	64	36	158	156	511	697
E_2'	58	68	72	84	50	33	57	36	108	130	262	333
F_1'	46	60	56	97	38	28	57	36	85	112	359	299
F_2'	48	58	61	82	46	28	50	29	94	112	349	379
G_1'	51	67	54	74	38	24	56	32	89	111	327	262
G_2'	55	66	53	67	44	32	60	36	99	113	257	287
G_3'	51	56	57	67	60	34	62	36	112	119	279	327
G_4'	61	70	72	84	58	35	54	36	119	126	299	371
H_1'	57	88	62	79	57	36	62	36	114	124	379	396
H_2'	78	100	74	81	60	36	61	36	138	134	327	407
I_1'	44	83	43	96	54	36	42	30	98	86	396	391
I_2'	81	95	90	100	70	36	67	36	151	157	309	403
Mean	57.9	73.8	62.7	83.6	52.7	33.4	57.8	35.1	110.8	120.6	330.8	389.4

[a]Corrected for guessing; [b]Last item attempted; [c]Totals may not add because of rounding error.

APPENDIX A5

First and Second Administration Scores of the Sequential Tests of Educational Progress (STEP) Listening Test 1A for 16 Male Subjects and 18 Female Subjects

Male	First Admin.	Second Admin.	Female	First Admin.	Second Admin.
A 1	300	300	B'1	295	307
B 1	319	332	B'2	319	314
C 1	319	303	C'1	295	300
D 1	323	319	C'2	307	319
D 3	314	300	C'3	307	300
E 1	292	300	D'1	332	310
E 2	319	314	E'1	352	352
F 1	310	314	E'2	300	323
F 2	352	332	F'1	310	319
G 1	286	295	F'2	307	303
G 2	332	344	G'1	344	314
H 1	298	300	G'2	307	292
H 2	300	300	G'3	307	319
H 3	307	307	G'4	314	314
I 1	323	307	H'1	319	314
I 2	300	303	H'2	332	307
			I'1	282	290
			I'2	314	344
Mean	312.1	310.6	Mean	313.5	313.4

APPENDIX A6

Frequency Distributions of Item Statistics for Bench Mark Test Passages

Item-Test Correlations (Flanagan r)							Item Difficulties (Per Cent Passing)						
	Passage							Passage					
r	C 1	C 2	C 3	C 4	C 5	C 6	%	C 1	C 2	C 3	C 4	C 5	C 6
.90-.94							90-94	1					
.85-.89		1			4		85-89		2	3	2	4	2
.80-.84	1	1	5	2	1		80-84		1	2	1		5
.75-.79		4	5	4	3	1	75-79	4	5	1	6	1	4
.70-.74	1	1	5	3	3	1	70-74	2	3	4	2	2	3
.65-.69	6	1	3	2		2	65-69	5	3	6	1		2
.60-.64	1	9		4	4	4	60-64	1	1	1		2	
.55-.59	6	3	6		2	1	55-59	5	2	1	3	4	3
.50-.54	3	1	3	2		2	50-54	2	3	4	2	2	2
.45-.49	2	4	1	4	5	3	45-49		2	1	3	4	3
.40-.44		1	1		1	3	40-44	2	3		2	1	1
.35-.39	3	2	1	3	1	3	35-39		1	1	1	3	
.30-.34	2	2		1		2	30-34			2	1	1	
.25-.29					1	1	25-29	1	3	2	1		
.20-.24						1	20-24	1		1		1	
.15-.19						1	15-19	1	1	1			
N	25	30	30	25	25	25	N	25	30	30	25	25	25
Md.	56.6	60.6	69.5	62.6	62.6	47.0	Md.	62.0	59.5	65.3	57.0	55.1	72.0